CLAIMS

What is claimed is:

1. A superconducting transformer, comprising:

a first primary winding for electrically connecting with an alternating power source, and having a first plurality of turns of superconducting tape;

a second primary winding for electrically connecting with the source and having a second plurality of turns of superconducting tape;

a first secondary winding for electrically connecting with a load, the first secondary winding magnetically coupled to the first primary winding and having a third plurality of turns of superconducting tape;

a second secondary winding for electrically connecting with the load, the second secondary winding magnetically coupled to the second primary winding and having a fourth plurality of turns of superconducting tape;

a sheath surrounding all of the windings; and

wherein the first primary winding, the second primary winding, the first secondary winding, and the second secondary winding are concentrically nested; and

wherein each respective winding is comprised of a twisted filament superconductor having one or more filaments.

2. A superconducting transformer according to claim 1, wherein the filaments provide a superconductor loss response to a self-generated magnetic field decreased relative to an identical superconductor transformer having a filament superconductor which is not twisted.

3. A superconducting transformer according to claim 1, wherein the filaments provide a superconductor loss response to an externally applied magnetic field decreased relative to an identical superconductor transformer having a filament superconductor which is not twisted.

4. A superconducting transformer according to claim 2, wherein at least a majority of the decreased superconductor loss response is a decreased hysteresis loss.

5. A superconducting transformer according to claim 2, wherein the decreased superconductor loss response occurs within a magnetic field window of the transformer.

6. A superconducting transformer according to claim 4, wherein the decreased superconductor loss response occurs within a magnetic field window of the transformer.

7. A superconducting transformer according to claim 5, wherein the window is about 20 mT to 80 mT.

8. A superconducting transformer according to claim 6, wherein the window is about 20 mT to 80 mT.

9. A superconducting transformer according to claim 5, wherein the window is approximately 30 mT to 70 mT.

10. A superconducting transformer according to claim 6, wherein the window is approximately 30 mT to 70 mT.

11. A superconducting transformer according to claim 1, wherein at least the first primary and the first secondary windings are interleaved with each other.

12. A superconducting transformer according to claim 1 wherein at least the second primary and the second secondary windings are interleaved with each other.

13. A superconducting transformer according to claim 1, wherein the first and second primary windings are interleaved with one another and the first and second secondary windings are interleaved with one another.

14. A superconducting transformer according to claim 11, wherein the decreased superconductor loss response is 1/2 to 1/6 larger than a loss response which would be seen in an identical superconductor having a filament superconductor which is not twisted.

15. A superconducting transformer according to claim 12, wherein the decreased superconductor loss response is 1/2 to 1/6 larger than a loss response which would be seen in an identical superconductor having a filament superconductor which is not twisted.

16. A superconducting transformer according to claim 13, wherein the decreased superconductor loss response is 1/2 to 1/6 larger than a loss response which would be seen in an identical superconductor having a filament superconductor which is not twisted.

17. A superconducting transformer according to claim 11, wherein the decreased superconductor loss response is 1/4 to 1/12 larger than a loss response which would be seen in an identical superconductor having a filament superconductor which is not twisted and having a first primary winding and a first secondary winding that are not interleaved with each other.

18. A superconducting transformer, comprising:

a first primary winding for electrically connecting with an alternating power source, and having a first plurality of turns of superconducting tape;

a second primary winding for electrically connecting with the source and having a second plurality of turns of superconducting tape;

a first secondary winding for electrically connecting with a load, the first secondary winding magnetically coupled to the first primary winding and having a third plurality of turns of superconducting tape;

a second secondary winding for electrically connecting with the load, the second secondary winding magnetically coupled to the second primary winding and having a fourth plurality of turns of superconducting tape;

a sheath surrounding all of the windings; and

a high resistive matrix metal, which carries coupling currents between the filaments, embedded in the superconductor;

wherein the first primary winding, the second primary winding, the first secondary winding, and the second secondary winding are concentrically nested;

wherein each respective winding is comprised of a twisted filament superconductor having one or more filaments;

wherein the high resistance matrix metal is a metal alloy comprising of pure silver; and

wherein the high resistance matrix metal reduces a coupling current loss in a magnetic filed window of the transformer is reduced as compared to an identical transformer having a matrix of pure silver without alloying elements.

19. A superconducting transformer according to claim 18, wherein the high resistance matrix metal alloy comprises of Silver and Antimony.

20. A superconducting transformer according to claim 18, wherein the high resistance matrix metal alloy is at least 95% silver by weight.

21. A superconducting transformer according to claim 18, wherein the high resistance matrix metal alloy is approximately 99.8% silver by weight.

22. A superconducting transformer according to claim 19, wherein the high resistance matrix metal alloy consists of Silver and Antimony.